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A DYNAMICAL SYSTEMS APPROACH TO STUDYING MID-LATITUDE DYNAMICS AND WEATHER EXTREMES

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Résumé :

Extreme weather ocurrences carry enormous social and economic costs and routinely garner widespread scientific and media coverage. Many extremes (for e.g. storms, heatwaves, cold spells, heavy precipitation) are tied to specific patterns of midlatitude atmospheric circulation. The ability to identify these patterns and use them to enhance the predictability of the extremes is therefore a topic of crucial societal and economic value. We propose a novel predictability pathway for extreme events, by building upon recent advances in dynamical systems theory. We use two simple dynamical systems metrics: local dimension and persistence, to identify sets of similar large-scale atmospheric flow patterns which present a coherent temporal evolution. When these patterns correspond to weather extremes, they therefore afford a particularly good forward predictability. We specifically test this technique on European winter temperatures, whose variability largely depends on the atmospheric circulation in the North Atlantic region. We find that our dynamical systems approach provides predictability of large-scale temperature extremes up to one week in advance.

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